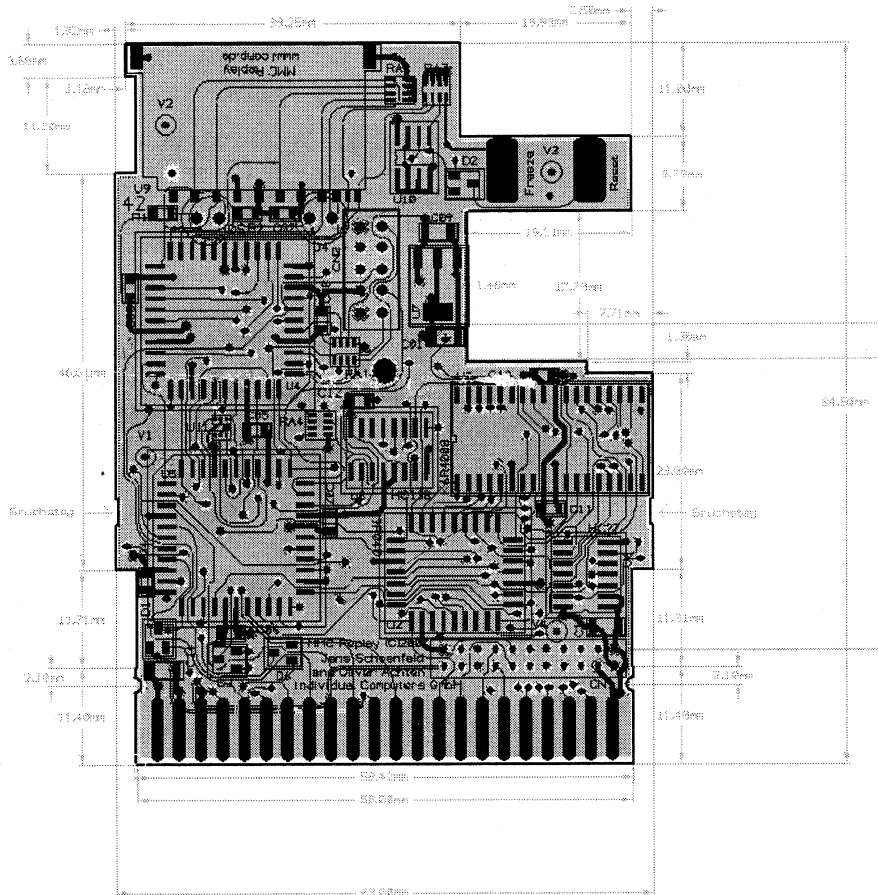


MMC Replay

User Manual



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for the most recent version of this document, please check <http://www.icomp.de>

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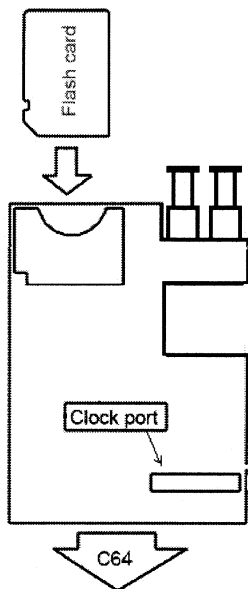
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User Manual

Hardware Installation

Insert the MMC Replay into the expansion port of your C64/C128. Make sure that the components on the MMC Replay are facing upwards. Now you can insert a FAT16 or FAT32 formatted Secure Digital or Multimedia flash card into the card slot on the upper left side. Turn on your machine, and after a short while, the blue BIOS title screen appears.

The following picture illustrates how to utilize the different ports of the MMC Replay:



Installing RR-Net

The clockport is intended for use with the RR-Net ethernet card. There is only one way to connect the RR-Net card, it does not fit the wrong way around. Make sure that you hit both pin rows, and never connect the card shifted!

MMC Replay has solderpads on the bottom side of the cartridge, where the RJ45 connector of RR-Net can be mounted permanently. This should only be done by authorized personnel, as the use of unsuitable tools might damage your equipment and void your warranty.

Preparing a flash card

The file browser supports both FAT16 and FAT32 filesystems. Long filenames are supported, but will be truncated to 15.3 in the Filebrowser. FAT16 is the standard filesystem that the Windows® operating system chooses when formatting a card. The same applies to Linux when creating a VFAT filesystem with default Parameters.

Creating the Filesystem (Formatting)

When formatting the flash card, please make sure to create either a FAT16 or FAT32 filesystem only. This is especially important if you want to format a card that is smaller than 32MB under Windows®, because Windows® chooses FAT12 as the default filesystem for that small size of cards.

Example (Windows®)

format G: /FS:FAT /V:MMC Replay /Q /X /A:512 (for a 32MB Card)
format G: /FS:FAT /V:MMC Replay /Q /X /A:8192 (for a 512MB Card)
format G: /FS:FAT /V:MMC Replay /Q /X (Cards bigger than 512MB)

Replace the drive letter „G“ and the volume name „MMC Replay“ with the correct drive letter of your setup and the volume name you wish to use. For further help on the format command, please type format /? for an explanation of the parameters.

Filling the Card with Files

Copy your favourite files to the card using your favourite file commander. If you are making a card with the „High Voltage SID Collection“, you should skip on PSID files, they are not supported by the player. SID and RSID files are supported.

Before removing the flash card from the writer, you **must** choose 'eject' from the context menu (right-click the volume on the windows desktop). On alternative operating systems choose the respective option to unmount the card. This will tell the computer to write all memory buffers to the card so you can safely remove it.

If you pull the card out of the reader/writer too soon, the contents of the card may be corrupted beyond repair – you may lose data forever !

Installing Plugins

Plug-in modules are stored in the SYSTEM64 directory which has to be created by the user manually in the root directory.

Currently you may install two plugins per file extension: one named <EXTENSION>PLGIN.BIN which is started by pressing RETURN with the cursor on the respective File, and another named <EXTENSION>PLGIN.ALT which is started by pressing SHIFT+RETURN.

Autostart File

It is possible to autostart a program after power-on or reset. To use this feature, place a binary named BOOT.BIN in the SYSTEM64 directory. This binary will then be loaded after power-on or reset, and started at its loading adress (which is, as usual, determined by its first two bytes).

Please note that the BOOT.BIN file is expected to be a machinecode file, not a basic program.

To prevent the autostart file from beeing executed, hold the CTRL key at power-on or reset. You can also permanently disable this feature in the configuration menu.

Using the MMC Replay

The MMC Replay has two buttons, the right button operates as reset. The left button is used to put the cartridge into freeze mode. The green LED indicates SD-Card access and the red LED is lit when the freeze button has been pressed. The red LED also indicates the recovery mode of the cartridge. See page 11 for more details.

Main Menu

The MMC Replay is equipped with a built-in BIOS to provide easy access to the data which is stored on the flash card. After power-on or reset you see the blue option screen with the following choices:

Key	Option
F1	Start Filebrowser
F3	Edit Configuration
F5	Flash Rom Tool
F7	Exit to BASIC
0-6	Start Rom Config

Note: if you disabled the BIOS in the setup, or want to skip the autoboot file, hold **CTRL** and then press reset to go to the main menu.

C128 Mode

Depending on a number of configuration settings a different ROM bank will be started:

C128 Bios on: always starts C128 Bios.

C128 Bios off, C128 bank != 7: starts default C128 bank.

C128 Bios off, C128 bank = 7, C64 bios = on: starts MMC Replay BIOS in C64 mode

C128 Bios off, C128 bank = 7, C64 bios = off: starts default C64 ROM bank

The MMC Replay C128 BIOS is a special C128 configuration screen so that the user can decide whether to use the C128 in its native mode or switch to the C64 emulation mode.

The C128 configuration menu has the following options:

Key	Option	Action
F1	Start MMC Bios	Switches back to C64 mode and starts the MMC Replay BIOS
F3	Edit Configuration	Works exactly the same way as in C64 Mode
F5	Exit to BASIC V2	Leaves the C128 Configurator and starts a C64 ROM bank
F7	Exit to BASIC V7	Leaves the C128 Configurator and starts a C128 ROM bank

Exit to BASIC V2

starts the ROM bank which has been selected as default „C64 bank“. If NONE, then Basic V2 will be started with no cartridge.

Exit to BASIC V7

starts the ROM bank which has been selected as default „C128 bank“. If NONE, then Basic V7 will be started, if 7 then MMC Replay BIOS will be started in C64 mode.

Note that once a C128 has been switched into C64 emulation mode, there is no way to go back besides resetting the machine. Selecting a C64 ROM bank will always switch the C128 into C64 emulation mode. Selecting a C128 ROM bank will keep the C128 mode when the selected ROM bank is configured as „Super Mapper“. Otherwise, C64 emulation mode is chosen.

Filebrowser

Press the **F1** key to start the file browser. The C64 is now reading the data stored on the flash card. The directories are displayed on the left side of the screen, files are displayed on the right side of the screen. In the top left of the screen, the name and model of your flash card are displayed. If the line is displayed in yellow, then the FAT16 filesystem has been found. If the line is displayed in cyan, then the filebrowser has found the FAT32 filesystem.

You can now navigate through the file structure of the card using the **RIGHT SHIFT,CRSR UP/DOWN,CRSR LEFT/RIGHT** keys. You might have to get used to using the right shift key with the cursor keys. The left shift key has a different function: It speeds up the repeat rate of the cursor keys, so you can navigate to the desired file faster. While browsing on the left side, pressing **RETURN** changes directories. **RETURN** on the right side of the screen causes different actions which are determined by the file extension.

Ext.	Type	Action
prg	C64 executable	Load & start instantly
sid	C64 SID tune	Play in the built-in soundplayer
d64	Disk image	Write image to floppy disk
crt	Cartridge image	Execute standard 8K and 16K cartridges

If the file extension differs from the types shown above, the filebrowser tries to load a plugin module associated with the file type. If no plugin is found, the action in the above table will take over. PRG and CRT Files are an exception, as they will always be autostarted and no plugin will be used.

After running a PRG or CRT file, or mounting a D64, you can press the freeze button at any time to get back to where you left of in the filebrowser, so you can easily run a different file, or change the mounted D64.

You can leave the file browser anytime by pressing the **RUN STOP** key.

Keys

Key	Action
Cursor Keys / Right shift	Navigate up/down/left/right
Left shift	Accelerate cursor movement
Return	Change dir, load file, start associated plugin (**)
Shift+Return	Start alternative plugin (.alt extension)
Run Stop	Exit to main menu
D	Create empty D64 / read D64 from IEC drive
1	Insert D64 or D71 into Image Slot 1 (*)
2	Insert D64 into Image Slot 2
F1	Go to top of directory list
F3	Enter D64 Browser
F7	Go to bottom of directory list
M	Make a new directory
H	View Help

(*) D71 Images can only be used in the first Slot

(**) pressing C= while loading a PRG file disables autostart after loading the PRG file

Inside the D64 Browser

Key	Action
Return	Load and start PRG
M	Mount D64 and exit to basic
F5	Go back to filebrowser

Edit configuration

Press the **F3** key to enter the configuration menu. You have the following options:

Option	Description
Enable C64 Bios	Enable/disable the BIOS on power-up (*)
Enable C128 Bios	Enable/disable the C128 BIOS on power-up (*)
Default C64 bank	Default Cartridge Bank
Default C128 bank	Default Cartridge Bank in C128 Mode
Boot from Card	Start boot file from SYSTEM64 directory on power-up
SD/MMC Card type	<i>see text</i>
D64 drive numbers	<i>see text</i>
IEC Drive Number	<i>see text</i>
Set RR-Net MAC address	<i>see text</i>

(*) The BIOS is always enabled by pressing the **CTRL** key on power-up.

Key	Action
Cursor Keys	Select option
Return	Modify setting
F1	Exit menu/back to main menu
F7	Save settings

Use the cursor keys to navigate through the options and press **RETURN** to change the value. You can choose between the following options:

Enable C64 BIOS

Determines whether the MMC Replay BIOS is started on reset. Disabling this option will skip the BIOS and automatically start the default C64 ROM bank. The BIOS is always enabled by pressing the **CTRL** key on power-up.

Enable C128 BIOS

Determines whether the C128 MMC Replay Bios is started on reset. Disabling this option will skip the C128 BIOS and automatically start the default C128 ROM bank. Selecting „no" will start the default C128 bank on startup. The BIOS is always enabled by pressing the **CTRL** key on power-up.

Default C64 bank

Determines which ROM bank is started when quitting the MMC Replay BIOS. Select NONE to start the C64 with no ROM bank.

Default C128 bank

Determines which ROM bank is started when quitting the C128 MMC Replay BIOS. Starting a ROM bank with an Action Replay/Retro Replay or RR+MMC64 mapper will automatically switch the C128 into C64 mode. Select NONE to start the C128 mode with no ROM bank and BASIC V7. Selecting bank 7 will start the MMC Bios in C64 mode.

Boot from card

Selects if a boot file called "BOOT.BIN" should be loaded during startup. Disabling this option will speed up the boot procedure.

SD/MMC card type

For compatibility reasons, you can specify a certain card type in case the autodetection is failing.

D64 drive numbers

With this option, you can specify the drive numbers of the D64 mounter.

IEC device number

Determines the drive number of the IEC device you have connected. This number will be used when writing to and reading from floppy.

Set RR-Net MAC address

Determines which MAC address is loaded into the RR-Net during startup. When pressing enter, you are required to enter a 12 digit MAC number in hexadecimal format.

RR-Net: shows type and Revision of RR-Net connected to the MMC Replay

MAC Addr: shows current MAC address.

Flashrom Tool

Press F5 in the main menu to enter the flashrom tool. If the border is **grey**, then memory protection is active and flashing is not possible. Memory protection is automatically activated after loading files. To disable memory protection press the reset button.

Now select the ROM bank you want to update by pressing 0...6 or 7 for updating the MMC Replay BIOS.

Key	Option	Action
F1	Exit to Main Menu	Leave Flashrom Tool and go back to main menu.
0-7	Select ROM bank	Select a ROM bank for flashing

After selecting a ROM bank, you will get the following choices:

Key	Option	Action
F1	Flash bank	Flash a ROM image to this bank
F3	Erase bank	Remove ROM image from this bank
F5	Set config	Enter name and set mapper for this bank
F7	Exit menu	<i>self explaining</i>

Press **F1** to flash a ROM image. You will be prompted to select a file in the Filebrowser. Select it and press **RETURN**. Now the image will be flashed. After that a configuration dialogue will ask you to choose a mapper, and to enter a name for that ROM bank. The later can also be done seperatly by choosing **F5** later.

The following cartridge images work unmodified:

Action Replay Mapper: classic Action Replay, Atomic Power, Nordic Power (all cartridges which work on Action Replay or Nordic Power Hardware, or their respective Clones)

Retro Replay Mapper: Retro Replay, Final Replay (all cartridges which work on RetroReplay Hardware)

RR + MMC64 Mapper: all Cartridges that work on a combination of RetroReplay and MMC64 hardware. Select this mapper if you want to use MMC64 registers. Action Replay and Retro Replay mappers disable them to increase freezer compatibility.

Standard 8k „CBM80“ cartridges can be used with either the „Action Replay“ or the „Retro Replay“ mapper.

Super Mapper: 16k mapper designed for new freezer ROM designs. It can also be used to start standard 16k „CBM 80“ images. This mapper is also designed for C128 ROMs.

SID Player

The SID player supports SID and RSID files. If you are making a card with the „High Voltage SID Collection“, you may skip the PSID files, as they are not supported.

Key	Action
+/-	Play next/previous subtune
Return	Restart tune
CTRL	Fast forward
Space	Blank screen
C=	Fix Volume (for silent tunes)
Run Stop	exit

Updating the BIOS

In the flashrom tool simply select bank 7, browse to a `MMCRBIOS.BIN` bios update file, press **RETURN** and follow the instructions on screen.

Create a Recovery Disk

BIOS updates come as two files: `MMCRBIOS.BIN`, which is the plain ROM bank image you can flash using the flashrom tool, and `RECOVERY.D64`, which is a disk image containing the recovery flash utility.

Before you update the BIOS, please create yourself a recovery disk using the builtin d64 writer and store it in a safe place.

This is especially important if you do not have a way to transfer files to a real disk other than the MMC Replay. It will enable you to recover from a bad BIOS flash yourself, so you do not have to send the MMC Replay to Individual Computers for service.

Recovery Mode

In case something went wrong during the BIOS update process, do not panic. Press and hold freeze, then press and release reset, then release the freeze button. This will reset the C64 and put the MMC Replay into hardware recovery mode. The recovery mode is indicated by the red LED, which is always on in that mode. Your computer will start with the normal startup-screen. It will behave as if no cartridge is installed. Now load `RECOVERY.PRg` from your recovery disk and run it to flash the BIOS.

Appendix

Available Plugins

Since MMC Replay is backward compatible to both MMC64 and RetroReplay, (nearly) all existing plugins written for these products can be used.

The following list (and related downloads at <http://www.icomp.de>) is provided for your convenience. Please note that some of these plugins are **not** made and supported by Individual Computers. Please send questions about using specific plugins to their respective authors.

Picture Plugins v1.3	KOA DOD OCP IPH HED ART PMG	Oliver Achten / Individual Computers	Displays pictures of different formats (Koala - *.koa, Doodle - *.dod, Advanced Art Studio - *.ocp, Interpaint (Hires) - *.iph, Hi-Eddi - *.hed, Art Studio - *.art, Paint Magic - *.pmg)
ANI Plugin v1.1	ANI	Oliver Achten / Individual Computers	Playback *.ani files used by the IDE64 module.
AVF Plugin V0.3	AVF	Oliver Achten / Individual Computers	Play back custom AVF videos with sound (MP3@C64 is supported, but can unfortunately not be used with MMC Replay).
D64 Reader v0.5	D64	Oliver Achten / Individual Computers	Read a disk inserted into your 1541 drive to a disk image on your card.
D64 Writer Plugin v0.92	D64	Kratznagel	Writes a standard D64 image back to a 1541 or compatible floppy device in about 80 seconds.
D64 Reader plugin (fast)	D64	Engine/DSS	Read a disk inserted into your 1541 drive to a disk image on your card.
D64/D71 Mounter	D64 D71	TNT/Beyond Force	Mount D64 and D71 image files.
D81 Writer v0.2	D81	TNT/Beyond Force	Write D81 images to disk.
RAW Plugin	RAW	TNT/Beyond Force	Playback raw unsigned 8-bit samples.
WAV Plugins	WAV	StreetTuff/TRSI	Plays Wave Audio Files
Text viewer Plugin v0.02	TXT	fieserWolf/METALVOTZE	40 column text viewer.
Text viewer Plugin v0.10	TXT	fieserWolf/METALVOTZE	80 column text viewer.
SidWatcher (siw)	SID	fieserWolf/METALVOTZE	Alternative SID player (rename

plugin v0.03			plugin to SIDPLGIN.BIN).
DFI Mounter	DFI	Doc Bacardi	A multiload file system using an alternative container format.
T64 Plugin v0.07	T64	DrCreep	Loads files out of T64 images.
REU Plugin	REU	Hannenz	Saves and restores REU contents to/from a file.

Available Software

Since MMC Replay is backward compatible to both MMC64 and RetroReplay, (nearly) all existing Software written for these products can be used.

The following list (and related downloads at <http://www.icomp.de>) is provided for your convenience, please note that this Software is **not** produced by Individual Computers. Please send questions about using specific programs to their respective authors.

Guruterm	c/g capable Telnet client	http://noname.c64.org/csdb/release/?id=33555
Contiki	Multitasking OS with webserver	http://www.sics.se/contiki/
Artillery Duel	Internet game	http://home.ica.net/~leifb/commodore/duel/
Warpcopy	Disk transfer tool	http://www.oxyron.de/html/wc64.html
Codenet	Crossdevelopment transfer tool	http://www.oxyron.de/html/freplay.html
Netdrive	Network D64 mounter	http://www.oxyron.de/html/freplay.html
Netmon	Remote debugger	http://freenet-homepage.de/hannenz/netmon.html
DiskImagery64	Disk transfer tool	http://lallafa.de/blog/index.php/diskimagery64/
Dreamload for MMC64	MMC capable IRQ loader	http://developer.berlios.de/projects/rrtools/
singular browser	Alternative filebrowser	http://singularcrew.hu/browser/

Technical data

Subject to change without notice.

Memory:

- 4 Mbit (512K x 8) Ram, addressable in 8K or 16K banks
- 4 Mbit (512K x 8) Flash ROM, sector-erasable, addressable in 8K or 16K banks
data retention: 20 years, minimum 100.000 write/erase cycles
- 8 Kbit serial EEPROM, data retention: 100 years, endurance: 1 million write cycles

Printed circuit board:

- 4-layer multilayer board
- size 63 x 84.5 mm
- white silkscreen print
- two green solderstop layers
- number of drills: 245
- number of drill diameters: 6
- hard gold surface connector, gold area: 495 mm²

Programmable logic:

- two 64-macrocell CPLDs
- total design size: 127 macrocells
- total IO pins: 60
- 3.3V IO voltage (5V tolerant), 3.3V core voltage

Mechanical:

- jumper-free design
- 2-way guided pushbuttons, guaranteed number of push cycles: 10 million
custom colour Pantone 284C (light blue)
- MMC/SD-card slot with flashgold contacts, 1 million insertion cycles
- expansion port: 2x11 pins, raster 2mm, mostly compatible with Amiga „clockport“

Electrical:

- total current w/o flash card and w/o RR-Net: 130 mA idle, 150mA during flash update
- total power: 0.75 W

Further Information

Please note that external links and references are neither supported, nor under control or responsibility of Individual Computers.

- Official Individual Computers website: <http://www.icomp.de>
- Retro Hackers Forum: <http://retrohackers.com/forum/>
- German C64 Wiki: <http://www.c64-wiki.de/>
- English C64 Wiki: <http://www.c64-wiki.com/>
- German C64 Forum with **inofficial** MMC Replay related subforum:
<http://www.forum64.de/>
- Instructions and tools to create a ROM image from your own original cartridges can be found at <http://markus.brenner.de/cartridge/index.html>

Last Words

Credits

Hardware developed by Oliver Achten and Jens Schönfeld.

Special thanks to John 'Graham' Selck for useful Ideas and Suggestions.

Fine print

MMC Replay and RR-Net are not designed, authorized or warranted to be suitable for use in life-support devices or systems or other critical operations. Inclusion of the product in such applications is understood to be fully at the customer's risk.

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